

Slurry Retrieval, Pipeline Transport & Plugging and Mixing Workshop

Monday – Friday, January 14 – 18, 2008

Marriott Courtyard Orlando Lake Buena Vista in the Marriott Village, Orlando, Florida

MEETING PROGRAM

**Sponsored by the U.S. Department of Energy
Office of Engineering and Technology
Office of Environmental Management**

Slurry Retrieval, Pipeline Transport & Plugging and Mixing Workshop

Monday – Friday, January 14 – 18, 2008

Marriott Courtyard Orlando Lake Buena Vista in the Marriott Village, Orlando, Florida

Workshop Organizers:

Gary L. Smith, Adam P. Poloski, and Michael W. Rinker
Pacific Northwest National Laboratory

Sharon L. Marra
Savannah River National Laboratory

Rick Demmer
Idaho National Laboratory

Benjamin E. Lewis Jr.
Oak Ridge National Laboratory

Arthur W. Etchells, III
AWE3 Enterprises

**Sponsored by the U.S. Department of Energy
Office of Engineering and Technology
Office of Environmental Management**

INTRODUCTION

Slurry Retrieval, Pipeline Transport & Plugging, and Mixing Workshop

The DOE Office of Engineering and Technology, Office of Environmental Management is sponsoring a slurry handling workshop which is being coordinated by Pacific Northwest National Laboratory, Savannah River National Laboratory, Oak Ridge National Laboratory, and Idaho National Laboratory with help from commercial slurry processing companies. The workshop will focus on slurry retrieval, transport, mixing, etc. The objective of this effort will be to generate a manual/report documenting slurry transport to include mobilization and transport technologies focusing on the risks associated with slurry retrieval, mobilization, pipeline plugging, and stratification of slurries in vessels. The manual/report will also include aspects of slurry characterization consensus methods and design of slurry mobilization and transport that will allow for comparable results and system designs among DOE sites. The meeting will be attended by over fifty people from radioactive waste storage sites in North American and beyond as well as both commercial firms and academic institutions. The workshop will be held in Orlando, Florida the week of Monday, January 14, 2008. The first two days will be a short course on slurry mixing and handling; the last three days will be presentations and workshops on best practices, lessons learned, etc. (Requests for further information should be directed to Gary L. Smith, (509) 372-1957, Gary.L.Smith@pnl.gov)

SLURRY RETRIEVAL, PIPELINE TRANSPORT & PLUGGING, and MIXING WORKSHOP

Workshop Agenda:

Monday, January 14, 2008

8:00 am Short Course
9:30 am Break
12:00 pm Lunch on Own
1:00 pm Short Course
2:30 pm Break
4:30 pm End First Day Short Course

Dinner on Own

Tuesday, January 15, 2008

8:00 am Short Course
9:30 am Break
12:00 pm Lunch on Own
1:00 pm Short Course
2:30 pm Break
4:30 pm End Short Course

6:30 pm Group Dinner at Landry's Seafood

Wednesday, January 16, 2008

8:00 am	Workshop Welcome and Introduction	Steve Krahn
8:10 am	Workshop Purpose and Format	Gary L. Smith
8:30 am	Hanford Site Presentation	
	a. Waste Slurry Physical Properties – Adam Poloski	
	b. Tank Waste Retrieval – Rick Raymond	
	c. Waste Transport – Rick Raymond	
	d. Waste Processing – Adam Poloski	
10:00 am	Break	
10:30 am	Savannah River Site Presentation – Sharon Marra	
	a. Sludge Waste Removal and Tank Closure - Noel Chapmen	
	b. Work Supporting Removal of Slurries from Waste Tanks, Transport of Slurries in Pipelines, and Separation of Solids from Liquids at SRS – Michael Poirier	
	c. Overview of the Design Basis, Operating Experience, and the Application of Laboratory Data to Support the Transport and Mixing of Sludge Slurries in the Defense Waste Processing Facility - Jonathan Bricker	
12:00 pm	Lunch on Own	

- 1:00 pm Idaho Site Presentation – Rick Demmer
a. Waste Slurry Physical Properties
b. Tank Waste Retrieval
c. Waste Transport
d. Waste Processing
- 1:30 pm Oak Ridge Site Presentation – Ben Lewis
e. Waste Slurry Physical Properties
f. Tank Waste Retrieval
g. Waste Transport
h. Waste Processing
- 2:00 pm Break
- 2:30 pm Break-Out Sessions: What do we need for final product (report/manual)?
a. Retrieval
b. Transport
c. Processing
- 4:00 pm Feed Back and Report Out from Break-Out Session Chairs
- 4:30 pm Key Note Speaker “Third Party Reviews – An Industrial Best Practice” Rick Bockrath
- 5:30 pm Adjourn Workshop
- Dinner on Own

Thursday, January 17, 2008

- 8:00 am Key Note speaker on “The Problem with Solids” David Gottschlich
- 9:30 am Break
- 10:00 am Break-Out Sessions: How to prevent problems on DOE projects?
a. Retrieval
b. Transport
c. Processing
- 11:30 am Feed Back and Report Out from Break-Out Session Chairs
- 12:00 pm Lunch on Own
- 1:00 pm Discussion of Path Forward – Report from the Workshop
- 2:00 pm Break

- 2:30 pm Break-Out Sessions: Path Forward
- a. Retrieval – Mobilization to Overcome Shear Strength, David Boger Moderator
 - b. Transport – Open Channel Flow, Robert Cooke Moderator
 - c. Processing – Pulse Jet Mixers (PJM), Art Etchells Moderator
- 3:30 pm Feed Back and Report Out from Break-Out Session Chairs
- 4:00 pm Key Note Speaker on “Rheology and Surface Chemistry of Slurries” David Boger
- 5:30 pm Adjourn Workshop

Dinner on Own

Friday, January 18, 2008

- 8:00 am Key Note Speaker on “Slurry Retrieval & Transport” Robert Cooke
- 9:00 am Break-Out Sessions: Short talks on various topics:
- Overview of Advanced Design Mixer Pump Program – Robert Leishear
 - Impeller Diameter Reduction of a Radioactive Sludge Transfer Pump – Tom Caldwell
- 10:00 am Break
- 10:30 am Break-Out Sessions: Short talks on various topics:
- Examples of Slurry Retrieval, Pipeline Transport & Plugging and Mixing issues at Sellafield in the UK – Tim Tinsley & Dominic Rhodes
 - Lessons Learned in Operating the Hose-In-Hose System for Transferring Sludge at Hanford’s K Basins - Gary Hofferber & Curt Miska
 - On the Formation and Treatment of Trisodium Phosphate Plugs – Jeff Lindner et al.
- 12:00 pm Lunch on Own
- 1:00 pm Break-Out Sessions: Short talks on various topics:
- Tomography to Investigate Closed Systems – Tim Tinsley & Dominic Rhodes
 - Mixing Within the Salt Waste Processing Facility [SWPF] – Air Pulse Agitators (APA’s) – Sam Shicks
 - Scale-Up Of Solids Suspension Agitation – Dave Dickey
- 2:30 pm Closing Discussion and Assignments
- 3:00 pm Close the Workshop

Timetable for Slurry Handling Workshop Short Course

<i>MONDAY, 14 JANUARY 2008</i>	
08:00	Welcome and Introductions
08:10	Introductions <i>Art Etchells</i>
08:30	What is Mixing and Why It Matters – Introduction and what will not be covered <i>Art Etchells</i>
08:50	Process Result - Mixing Equipment <i>Art Etchells</i>
09:30	Coffee
09:40	Mixing Concepts I – turbulence, power, flow patterns, settling <i>Art Etchells</i>
10:30	Viscosity and the Flow Curve <i>Nigel Heywood</i>
11:00	Flow Curve Measurement <i>Nigel Heywood</i>
11:45	LUNCH
12:30	Mixing Concepts II – Blending liquids; Liquid-Liquid Dispersions <i>Art Etchells</i>
13:45	Coffee
14:00	Physical Basis of Dispersion Rheology <i>Nigel Heywood</i>
15:15	Pumps and Pumping <i>Nigel Heywood</i>
16:15	General Discussion and Close of Day
<i>TUESDAY, 15 JANUARY 2008</i>	
08:00	Yield Stress Measurements <i>Nigel Heywood</i>
08:45	Liquid Blending – yield stress materials <i>Art Etchells</i>
09:30	Coffee
09:45	Chemical Basis of Dispersion Rheology <i>Nigel Heywood</i>
10:30	Solid-Liquids Mixing – off bottom and distribution and attrition <i>Art Etchells</i>
11:45	LUNCH
12:30	CFD to Solve Single Phase and Solid-Liquid Mixing Problems <i>Art Etchells</i>
13:15	Pipeline Design for Non-Settling Slurries <i>Nigel Heywood</i>
14:45	Coffee
15:00	Pipeline Design for Settling Slurries <i>Nigel Heywood</i>
16:00	General Discussion and Close of Course

MIXING, RHEOLOGY AND SLURRY HANDLING COURSE

Art Etchells III and Nigel I Heywood

Lecturers



Art Etchells III

Dr. Arthur Etchells was a DuPont Fellow in DuPont Engineering Technology, part of the DuPont Company. DuPont Fellow is the highest technical position in the DuPont Company. There are currently sixteen DuPont Fellows in a company of about 85,000 people. In his 39 years with DuPont his chemical engineering expertise, particularly in mixing and fluid flow, has resulted in significant improvements to many DuPont manufacturing businesses. He has developed and used mixing technology for a variety of businesses such as White Pigments, Tyvek® spun bonded, Nomex® polyaramid, Lycra® spandex fiber, Agricultural Products, and nylon and polyester intermediates.

Outside of DuPont, Dr. Etchells is an internationally recognized authority in the field of mixing with many publications. He is a founding member and former president of the North American Mixing Forum, an affiliate of the AIChE. He teaches at the Chemical Engineering Department of the University of Delaware as an adjunct professor and teaches continuous education courses in Europe and the United States.

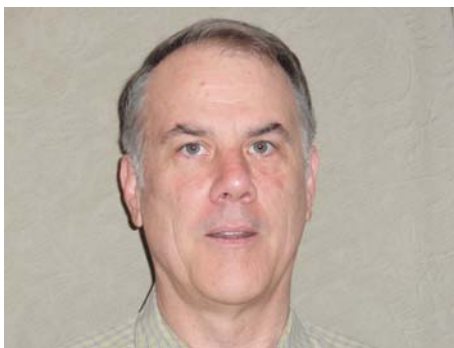
Recently Dr. Etchells received the Lavoisier Award and Medal of Achievement, the DuPont Company's highest award for scientific and technical achievement. The award citation says "In the past twenty years he has worked with a group of industrialist and academics to convert mixing technology from a qualitative empirical methodology into a technically sophisticated discipline changing the ways the process industries look at chemical reactions, formulations and scale-up processes." At the end of October 2002, Dr. Etchells retired from DuPont. He still consults with DuPont as a contractor and is available for lectures and consulting in the fields of mixing and fluid flow with other companies and universities.



Dr Heywood is a chartered chemical engineer and Fellow of the Institution of Chemical Engineers. He graduated with first class honours in chemical engineering from Imperial College, London University, in 1972. After having obtained a MSc in Advanced Chemical Engineering with a Mark of Distinction at Imperial College, he undertook research into the effect of air injection into slurry flow in pipes at the University of Wales, receiving the PhD degree in 1976. He continued research into multiphase pipeflow at the University of Toronto, Canada, before returning to England to work at Warren Spring Laboratory in 1979, and joined AEA Technology in 1994 and then Aspen Technology in 2002 where he managed the slurry handling and bulk solids handling areas of Aspen Technology's Process Manual.

Nigel I Heywood

In October 2005, he joined the BHR Group to continue the rheology, slurry handling and bulk solids handling consultancy and courses business. He lectures on rheology, slurry handling, bulk solids handling, mixing and on-line instrumentation, has written over 100 articles and reports, and a book entitled "Slurry Handling: Design of Solid-Liquid Systems. He obtained an Executive MBA and DIC from Imperial College in 1996.



RICHARD BOCKRATH

Rick has over 30 years with DuPont with assignments primarily in technical organizations. Prior to joining the Centralized Engineering Function in 2000, Rick worked in various business units and was focused primarily on managing applied research and manufacturing support technology groups. Assignments included development of basic data for large, new technology projects; commercialization of new technology in projects costing up to \$250MM, improvement of large projects with significant technology shortcomings; responsibility for the short-term research and manufacturing technology groups within the Specialty Chemicals business grouping; responsibility for the Special Studies group which reported directly to the Vice President of R&D for the Chemicals Sector businesses; responsibility for providing technology oriented computer services across the DuPont Chemicals Sector and bottom line P&L responsibility for the global Terathane® business.

Education:

BScE – University of Delaware, 1975

MSChE – University of Delaware, 1976

ScD – Massachusetts Institute of Technology, 1981

Thesis: “Conversion of Oxygenates to Hydrocarbons over ZSM-5”

MBA – Widener University – 1985

Delaware Professional Engineer License - #5716



David Gottschlich

David Gottschlich is the Chief Scientist at Independent Project Analysis, Inc. (IPA) and also serves as the head of IPA's Review Board. David joined IPA in 1990, and, during his time with the company, he has led numerous benchmarking studies and individual project evaluations for a wide range of industries and clients. He played a key role in benchmarking studies for the U.S. DOE, both Defense Programs and Waste Management. He has also participated in re-engineering studies of capital project systems and has authored several research studies.

David has several areas of expertise, including new technology, pharmaceutical industry, forest products, specialty chemicals, and modeling the connections between outcomes and practices.

Prior to joining IPA, David worked in R&D and with projects at Westvaco (now MeadWestvaco).

David holds a Ph.D. and an MA in Chemical Engineering from Princeton University and earned a BA in Physics from the University of Pennsylvania in Philadelphia.

Dr. David A. Gottschlich
Independent Project Analysis, Inc.
44426 Atwater Drive
Ashburn, Virginia 20147
(703) 726-5363 Office
(703) 729-8300 Receptionist
(703) 729-8301 Fax
E-mail: dgottschlich@ipaglobal.com



Professor David Vernon Boger

B.S.Chem.Eng., Bucknell University
M.S.Chem.Eng., University of Illinois
Ph.D.Chem.Eng., University of Illinois

Laureate Professor

Email: dvboger@unimelb.edu.au

Telephone: (61) 3 8344 7440

Fax: (61) 3 8344 6233

David V Boger has held positions in Chemical Engineering at both Monash University and The University of Melbourne. Currently he is Laureate Professor and Professor of Chemical Engineering at The University of Melbourne. He is immediate past Director of the Particulate Fluids Processing Centre (a Special Research Centre of the ARC), past Head of Chemical Engineering and former Deputy Director of the Advanced Mineral Products Centre. His research is in non-Newtonian fluid mechanics with interests ranging from basic polymer and particulate fluid mechanics to applications in the minerals, coal, oil, food, and polymer industries. From 1991-2002 Professor Boger was Chairman of the Trade Waste Acceptance Advisory Committee, a group which advises the City of Melbourne on industrial trade waste discharges to the trunk sewer system. He held the position of BHP Billiton Fellow from 2000-2003.

Professional Organisations:

Fellow, The Royal Society

Fellow, Australian Academy of Science

Fellow, Australian Academy of Technological Sciences and Engineering

Member, Institute of Non-Newtonian Fluid Mechanics, The University of Wales (Aberystwyth, Bangor and Swansea)

Member, American Society of Rheology

Member, Australian Society of Rheology (Immediate Past President)

Member, British Society of Rheology

Publications:

320+ publications, which include books, book chapters, invited reviews, journal publications and conference proceedings. The most recent book is "Rheological Phenomena in Focus" co-authored by Professor K Walters (FRS), published in 1993

Professional Experience:

International consultant - having consulted for over 90 companies worldwide.

Recent international work has been with 3M Corporation in USA, Xerox Research Centre of Canada, Alcan

International Arvida Research Centre in Canada, Statoil in Norway and Tata Research Development & Design Centre in India, and with BHP and Orica (formerly ICI) in Australia

Honours:

Annual Award of the British Society of Rheology "In acknowledgement of your notable contributions to Rheology", 1983

Royal Society of Victoria Medal for Research, 1985

Fellow, Australian Academy of Technological Sciences and Engineering, 1989

Esso Award for Excellence in Chemical Engineering, 1991

Fellow, Australian Academy of Science, 1993

Pol Eureka Prize for Environmental Research, 1993

Australian Society of Rheology Medallion, 1994

Walter Ahlström Environmental Prize (\$80,000) of the Finnish Academies of Technology, 1995

1995 Alcoa (U.S.A.) Environmental Excellence Award

Special Chief Investigator Grant from the Australian Research Council, 1997-1999

CSIRO External Medal "for research excellence", 1998

Flinders Medal and Lecture, Australian Academy of Science, 2000

2000 Chemeca Medal

2002 Victoria Prize

Anne and Eric Smorgon Memorial Award 2002 (\$100,000 awarded in association with the Victoria Prize)

K L Sutherland Memorial Medal 2002

2003 Clunies Ross National Science and Technology Award

Commonwealth of Australia Centenary Medal, 2003

Gold Medal of the British Society of Rheology, 2004

The Prime Minister's Prize for Science, 2005

Donald L Katz Lectureship, The University of Michigan, 2006

Fellow, The Royal Society, 2007



Robert Cooke, PhD PrEng FSAIMM MSME
Principal, Paterson & Cooke

Robert is a founding partner of Paterson & Cooke, a specialist slurry transportation consultancy and design company. He obtained his PhD from the University of Cape Town in 1991 for research into the flow of high concentration backfill slurries. Paste and thickened tailings is a primary area of interest and Robert has been involved in the implementation of a number of systems. Robert is based in Paterson & Cooke's Denver office from where he is working on slurry pipeline projects in North and South America.

ATTENDEE REGISTRATION INFORMATION
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Fairfield Inn Orlando Lake Buena Vista in the Marriott Village, Orlando, Florida

Michael J. Augeri
Washington Savannah River Company
Savannah River Site, Building 766-H
Aiken, SC 29808
(803) 208-3125 Office
(803) 208-8234 Fax
E-mail: michael.augeri@srs.gov

Amer Awwad, M.S., P.E.
Applied Research Center
Florida International University
10555 W Flagler Street, EC 2100
Miami FL, 33174
(305)348-1676 Office
(305)348-1852 Fax
Email: awwada@fiu.edu

Timothy C. Baughman
Washington Savannah River Company
Savannah River Site, Building 766-H
Aiken, SC 29808
(803) 208-2038 Office
E-mail: timothy.baughman@srs.gov

Jim R. Bellomy
CH2M HILL Hanford Group, Inc.
P.O. Box 1500, MSIN S7-66
Richland, Washington 99354
(509) 372-1673 Office
(509) 372-2862 Fax
E-mail: Jim_Bellomy@rl.gov

Stephen Berry
EnergySolutions
2345 Stevens Drive, Suite 240,
Richland, WA 99354
(509) 375-9869 Office
(509) 375-9500 Fax
E-mail: sberry@energysolutions.com

Richard E. Bockrath, Ph.D.
Technology Manager - Process Engineering
Section
E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Brandywine Building B8446
Wilmington, Delaware, 19898
(302) 773-1259 Office
E-mail:
Richard.E.Bockrath@usa.dupont.com

David V. Boger, Ph.D.
Department of Chemical and Biomolecular
Engineering
The University of Melbourne
Victoria 3010, Australia
+(61 3) 8344 7440 Office
+(61 3) 8344 6233 Fax
Email: dvboger@unimelb.edu.au

Paul R. Bredt, Ph.D.
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K6-24
Richland, WA 99352
(509) 376-3777 Office
(509) 376-3108 Fax
E-mail: paul.bredt@pnl.gov

Jonathan Bricker
Savannah River Site
Building 704-27S, Room 2
Aiken, SC 29808
(803) 208-7162 Office
E-mail: Jonathan.Bricker@srs.gov

Robb Burk
Waste Treatment Plant (WTP) Project
2434 Stevens Center Pl., MS4-E2
Richland, WA 99352
(509) 371-3840 Office
(509) 371-3204 Fax
E-mail: raburk@bechtel.com

Marybeth D. Buxton
Washington Savannah River Company
Savannah River Site, Building 241-156H
Aiken, SC 29808
(803) 208-3566 Office
E-mail: marybeth.buxton@srs.gov

Thomas B. Caldwell
Savannah River Site
Liquid Waste Operations Division
Building 766-H
Aiken, SC 29808
(803) 208-8430 Office
(803) 208-2468 Fax
E-mail: thomas.caldwell@srs.gov

Noel F. Chapman
Savannah River Site Facility Engineering
Building 704-70F
Aiken, SC 29808
(803) 952-3806 Office
E-mail: noel.chapman@srs.gov

John M. Conner
CH2M HILL Hanford Group, Inc.
P.O. Box 1500, MSIN S5-08
Richland, Washington 99352
(509) 373-2711 Office
(509) 308-8727 Cell
(509) 373-0707 Fax
E-mail: John_M_Conner@rl.gov

Robert Cooke
Paterson & Cooke
1580 Lincoln Street, Suite 1000
Denver, CO 80203-1512, USA
(303) 867 2264 Office
(303) 629-8789 Fax
E-mail: RobertC@PatersonCooke.com

Rick Demmer
Idaho National Laboratory
P.O. Box 1625, MS 7113
Idaho Falls, ID 83415-7113
(208) 533-4277 Office
(208) 533-4207 Fax
E-mail: Rick.Demmer@inl.gov

David S. Dickey, Ph.D.
MixTech, Inc.
454 Ramsgate Drive
Dayton, OH 45430-2097
937-431-1446 Phone
937-431-1447 Fax
E-mail: d.dickey@mixtech.com

Arthur W. Etchells, III, Ph.D.
AWE3 Enterprises
315 S. 6th Street
Philadelphia, PA 19106
(215) 774-2238 Home
E-mail: Etchells3@aol.com

Joseph A. Faldowski
AREVA Federal Services
7207 IBM Drive
Charlotte, NC 28262
(704) 805-2838 Office
(704) 497-2202 Cell
(704) 704-805-2370 Fax
E-mail: joe.faldowski@areva.com

Drew Fellingner
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 723-A
Aiken, SC 29808
(803) 725-5705 Office
(803) 725-9753 Fax
E-mail: a.fellinger@srnl.doe.gov

Terri L. Fellingner
Washington Savannah River Company
Defense Waste Processing Facility
Savannah River Site, Building 704-26S
Aiken, SC 29808
(803) 208-6471 Office
(803) 208-6158 Fax
E-mail: terri.fellinger@srnl.doe.gov

Don Gagel
EnerGX
TRU Waste Processing Center
Oak Ridge National Laboratory
100 WIPP Road
Lenoir City, TN
(865) 576-1950 Office
(865) 254-5726 Cell
E-mail: don.gagel@truproject.com

Matt Gebhardt
Waste Treatment Plant (WTP) Project
2434 Stevens Center Pl., MS4-E2
Richland, WA 99352
(509) 371-3607 Office
E-mail: mjgebhar@bechtel.com

Kurt Gerdes
U.S. Department of Energy
Office of Engineering and Technology
19901 Germantown Road
Germantown, MD 20874
(301) 903-7289 Office
(301) 903-8344 Fax
(202) 615-6076 Cell
E-mail: Kurt.Gerdes@em.doe.gov

David A. Gottschlich, Ph.D.
Independent Project Analysis, Inc.
44426 Atwater Drive
Ashburn, Virginia 20147
(703) 726-5363 Office
(703) 729-8300 Receptionist
(703) 729-8301 Fax
E-mail: dgottschlich@ipaglobal.com

Mark N. Hall
Waste Treatment Plant (WTP) Project
2434 Stevens Center Pl., MS4-D2
Richland, WA 99352
(509) 371-3127 Office
E-mail: mnhall1@bechtel.com

Donald J. Hallbom, P.Eng.
Assistant General Manager
Pipeline Systems Inc. Engineering Ltd.
1140 West Pender Street, Suite 200
Vancouver, BC, V6E 4G1
Canada
(604) 221-6677 Office
(604) 221-6633 Fax
E-mail: dhallbom@pipesys.com

Erich Hansen
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 773-A
Aiken, SC 29808
(803) 725-3250 Office
(803) 725-4704 Fax
E-mail: erich.hansen@srnl.doe.gov

David Harbottle
Institute of Particle Science and Engineering
School of Process Environment and
Materials Engineering
University of Leeds
LS2 9JT
United Kingdom
+44 (0)113 343 2392 Office
E-mail: pre0dh@leeds.ac.uk

Connie Herman
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 999-W
Aiken, SC 29808
(803) 819-8417 Office
(803) 819-8416 Fax
E-mail: connie.herman@srnl.doe.gov

Nigel Heywood, Ph.D.
BHR Group Limited
The Fluid Engineering Centre
Cranfield, Bedfordshire.
MK43 OAJ
United Kingdom
+44(0)1234 750422 Office
+44(0)1234 750074 Fax
E-mail: nheywood@bhrgroup.co.uk

Gary A. Hofferber
Vista Engineering Technologies, L.L.C.
133 Riverwood St.
Richland, WA 99352
(509) 308-8084 Cell
E-mail: Gary_A_Hofferber@rl.gov

Hoyt C. Johnson
Department of Energy, EM-21
Forrestal Bldg.
Washington D.C.
(202) 586-0191 Office
(202) 586-5256 Fax
E-mail: hoyt.johnson@em.doe.gov

Graham Jonsson
Nexia Solutions Inc
Idaho Falls
USA
(208) 523-3308 Office
+447715700327 Cell
E-mail:
graham.h.jonsson@nexasolutions.com

Steven L. Krahn
Director, Office of Waste Processing
DOE, EM-21
Forrestal Bldg.
Washington D.C.
(202) 586-2281 Office
E-mail: steve.krahn@em.doe.gov

Dan Krementz
Savannah River National Laboratory
Robotics, Remote & Specialty Equipment
Building 723-A, Savannah River Site
Aiken, SC 29808
(803) 725-2410 Office
E-mail: daniel.krementz@srnl.doe.gov

Robert A. Leishear, PhD
Savannah River National Laboratory
Washington Savannah River Company
Engineering Development Laboratory
Savannah River Site, Building 786-5A
Aiken, SC 29808
(803) 725-2832 Office
(803) 725-7243; 19107 Page
(803) 725-2956 Fax
E-mail: robert.leishear@srnl.doe.gov

Benjamin E. Lewis Jr.
Oak Ridge National Laboratory
1 Bethel Valley Road
PO Box 2008, MS 6243
Oak Ridge, TN 37831-6243
(865) 574-4091 Office
(865) 574-6872 Fax
E-mail: lewisbejr@ornl.gov

Jeff S. Lindner, Ph.D.
Research Professor
Institute for Clean Energy Technology
Mississippi State University
205 Research Blvd
Starkville MS 39759
(662) 325-7641 Office
(662) 325-8465 Fax
E-mail: lindner@icet.MsState.Edu

Sharon L. Marra
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 773-A
Aiken, SC 29808
(803) 725-5891 Office
E-mail: sharon.marra@srnl.doe.gov

Dwayne McDaniel, Ph.D., P.E.
Research Engineer
Applied Research Center
Florida International University
10555 W Flagler Street, EC 2100
Miami FL, 33174
(305) 348-6554 Office
(305) 348-1852 Fax
E-mail: Dwayne.McDaniel@arc.fiu.edu
Attending: short course & workshop

C. Phil McGinnis
ORNL Environmental Programs
PO Box 2008, Oak Ridge TN 37831-6154
(865) 576-6845 Office
(865) 548-4692 Cell
(865) 241-1042 Fax
E-mail: mcginniscp@ornl.gov

Perry A. Meyer, Ph.D.
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K7-15
Richland, WA 99352
(509) 375-6694 Office
(509) 375-3865 Fax
E-mail: perry.meyer@pnl.gov

Thomas E. Michener
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K7-15
Richland, WA 99352
(509) 375-2162 Office
(509) 375-3865 Fax
E-mail: tom.michener@pnl.gov

Curtis R. Miska
Fluor Hanford
825 Jadwin Ave., MS A3-06
Richland, WA 99352
(509) 376-7103 Office
(509) 376-0250 Fax
E-mail: Curtis_R_Miska@rl.gov

J. Randy Neuville
Washington Savannah River Company
Defense Waste Processing Facility
Savannah River Site, Building 704-25S
Aiken, SC 29808
(803) 208-6032 Office
(803) 208-6158 Fax
E-mail: john.neuville@srs.gov

Franz Nigl
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K7-15
Richland, WA 99352
(509) 375-2365 Office
(509) 375-3865 Fax
E-mail: Franz.Nigl@pnl.gov

John M. Pareizs
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 773-A
Aiken, SC 29808
(803) 725-2840 Office
(803) 725-4704 Fax
E-mail: john.pareizs@srnl.doe.gov

Michael R. Poirier, Ph.D.
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 773-42A
Aiken, SC 29808
(803) 725-1611 Office
(803) 725-8829 Fax
E-mail: michael.poirier@srnl.doe.gov

Adam P. Poloski, Ph.D.
Pacific Northwest National Laboratory
902 Battelle Boulevard, MSIN P7-25
Richland, WA 99352
(509) 376-1684 Office
(509) 376-9781 Fax
E-mail: Adam.Poloski@pnl.gov

Richard E. Raymond
CH2M HILL Hanford Group, Inc.
P.O. Box 1500, MSIN S7-83
Richland, Washington 99354
(509) 372-8767 Office
(509) 373- 5030 Fax
E-mail: Richard_E_Raymond@rl.gov

Dominic Rhodes
Nexia Solutions Limited
B170 Sellafeld
Seascale
Cumbria
CA20 1PG
United Kingdom
+44 (0)19467 79257 Office
+44(0)19467 79007 Fax
E-mail:
dominic.rhodes@nexasolutions.com

Michael W. Rinker
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K5-22
Richland, WA 99352
(509) 375-6623 Office
(509) 375-2379 Fax
E-mail: Mike.Rinker@pnl.gov

David Roelant, Ph.D.
Assoc. Director for Defense & Security
Technologies
Florida International University's
Applied Research Center
10555 West Flagler Street, EC 2100
Miami, FL 33174
(305) 348-6625 Office
E-mail: roelantd@fiu.edu

Mike Schliebe
Fluor Hanford
825 Jadwin Ave., MS A3-08
P.O. Box 1000
Richland, WA 99352
(509) 376-1472 Office
(509) 376-0250 Fax
E-mail: Michael_J_Schliebe@rl.gov

Sam Shicks
Parsons
1080 Silver Bluff Road
Aiken, SC. 29803
(803) 643-2428 Office
(803) 643-2253 Fax
(803) 443-8017 Mobile
E-mail: Sam.Shicks@parsons.com

Gary L. Smith, Ph.D.
Pacific Northwest National Laboratory
902 Battelle Blvd., MSIN K6-24
Richland, WA 99352
(509) 372-1957 Office
(509) 376-3108 Fax
E-mail: Gary.L.Smith@pnl.gov

Rajiv Srivastava, Ph.D.
Pipeline Systems, Inc.
5099 Commercial Circle, Suite 102
Concord, CA
(925) 771-1115 Office
(925) 937-8875 Fax
Email: rsrivastava@pipesys.com

Steven R. Strand, Ph.D.
Senior Specialist
The Dow Chemical Company
Midland, Michigan 48674
(989) 636-0701 Office
E-mail: sstrand@dow.com

Herbert Sutter
20442 Afternoon Lane
Germantown, MD 20874
(301) 802-7677 Office
E-mail: Hsutter64@aol.com

Georgio Tachiev, Ph.D.
Applied Research Center
Florida International University
10555 West Flagler Street, EC 2100
Miami, FL 33174
(305) 348-6732 Office
(305) 632-9386 Cell
(305) 348-1852 Fax
E-mail: Georgio.Tachiev@fiu.edu

Steve Taylor, P.E., Ph.D.
NuVision Engineering
184B Rolling Hill Road
Mooresville, NC 28117
(704) 799-2707 Office
(704) 799-6426 Fax
(704) 778-6714 USA Cell
+44 (0) 7894 029771 UK Cell
E-mail: taylor@nuvisioneng.com

Kristopher D. Thomas
DOE Office of River Protection
WTP Engineering Division
2440 Stevens Center Drive
Richland, WA 99352
(509) 376-4755 Office
E-mail:
Kristopher_D_Thomas@orp.doe.gov

Tim Tinsley
Nexia Solutions Limited
B170 Sellafield
Seascale
Cumbria
CA20 1PG
United Kingdom
+44 (0)19467 79331 Office
+44(0)19467 79007 Fax
E-mail: tim.p.tinsley@nexasolutions.com

Jose M. Varona, M.S., PMP
Applied Research Center
Florida International University
10555 West Flagler Street, Suite 2100
Miami, FL 33174
(305) 348-6653 Office
(305) 348-1852 Fax
E-mail: varonaj@fiu.edu

Nicholas Vrettos
Savannah River National Laboratory
Remote Specialty Equipment
Savannah River Site, Bldg 730-A, Rm. 174
Aiken, SC 29808
(803)725-3296 Office
E-mail: Nicholas.Vrettos@srnl.doe.gov

Martin Williams
NuVision Engineering
184B Rolling Hill Road
Mooresville, NC 28117
(704) 799-2707 Office
(704) 799-6426 Fax
(704) 965-8629 Cell
E-mail: williams@nuvisioneng.com

Bill Wilmarth
Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site, Building 773-A
Aiken, SC 29808
(803) 725-1725 Office
(803) 725-8829 Fax
E-mail: Bill.Wilmarth@srnl.doe.gov